

NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3210

MIDTERM EXAM II

12/89Po

- This exam is open book and notes.
- There are three problems; each is equally weighted.
- Partial credit will be given; be sure to do some work on each problem.
- Be sure to include units in your answers.
- Please circle or underline your answers.
- Do *NOT* do any work on this sheet.
- Show *ALL* work.

1	
2	
3	
Total	

Name: _____

1. A laser has a lineshape given by

$$g(\nu) = \frac{4.25 \times 10^9}{(\nu - 2.83 \times 10^{14})^2 + 1.782 \times 10^{20}} . \quad (1)$$

- (a) Find the wavelength of the laser *and*
(b) find the spectral linewidth $\Delta\lambda$ of the laser.

Added information: The equation should read...

$$g(\nu) = \frac{4.25 \times 10^9}{(\nu - 2.83 \times 10^{14})^2 + 1.782 \times 10^{20}} . \quad (2)$$

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2. A Doppler-broadened CO₂ laser operating at 10.6 μm has a saturation irradiance of 1 mW/cm². Assuming an index of refraction of 1, find the frequency linewidth $\Delta\nu_{\text{Doppler}}$ of the source. (Do *not* make any temperature assumptions.)

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3. A laser that operates at 2 μm has a small-signal round-trip gain of 6% and a round-trip internal loss of 1.5%. The laser has one mirror that is 100% reflecting; the other mirror is partially transmissive.

The laser provides a measured output irradiance of 200 W·m⁻² when the output mirror has a transmission of 3%. By what factor will the output irradiance increase, if the output mirror is replaced by one with the optimum transmission for this laser?